Stibnite Gold Project
Environmental Impact Statement

Midas Gold Draft Hydrologic Model Proposed Action Report Technical Report
Dated May 10, 2018

EPA Review Comments

Note: The Disposition and Response columns will be filled out by AECOM after addressing each Comment

Number	Page # or Global	Section	Paragraph	Comment	Commenter Initials	Disposition A/M/O	Response & Responder's Initials
	General			It would be good to have a list of all of the assumptions used in the modeling effort listed in table or section. Often these assumptions are embedded throughout the document and are hard to find.	PL		
	General			The Report indicates some sensitivity analyses be performed using the Proposed Action model to assess climate change through simulation of wetter or dryer climatic periods than indicated by the historical record. An analysis of the sensitivity of different model results to uncertain parameters will be performed to identify a range of potential flow conditions that may be encountered during mining. In addition, the potential for flow in different geologic structures will be assessed through sensitivity analysis during simulation of Site operations. However, sensitivity analyses are not included. Bedrock hydraulic conductivity estimates from hydraulic testing (BC 2017) range from 3 x 10^{-4} to 5.9 ft/day (BC 2017). Results of the hydraulic testing of bedrock show a large range of hydraulic conductivities, which is expected when testing both fractured and unfractured portions of the crystalline rock. The potential for intermediate-scale groundwater flow in bedrock also exists in larger fault zones, such as the Meadow Creek, West End, and Scout Valley fault zones. Have these major variations been considered in the modeling efforts? The estimates the local effects of dewatering and water management strategies on groundwater levels and stream flows appear based on five zones within the Model Layers 1, 2, and 3. Please clarify how these different zones we used though out the modeling process. As indicated in the Existing Conditions report, a table of the data used to compute the water balance was to be provided upon completion of the Proposed Action model. Please include.	TM		

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		3.1.1 – Climate Variation Sensitivity analysis		Parameters and assumptions used in the meteoric water balance were adjusted such that estimates of annual totals of available water generally matched observed estimates of basin yield for the principal USGS surface water gaging stations, as described in the Revised Draft Hydrologic Model Existing Conditions Report (BC 2018a). How were these values adjusted?			
		3.1.3 - Dewatering		The MODFLOW-NWT Drain package was used to simulate drawdown required to depress groundwater levels in the pits as mining progresses. Were all of the aquifer units (5 Zones, 3 Layers) utilized? Were only using average regional conditions using bulk hydraulic conductivity and storativity estimates (BC 2018a) used in the analysis? Total simulated dewatering rates (including dewatering at the Yellow Pine, Hangar Flats, and West End pits) range from approximately 1,300 gallons per minute (gpm) at mine year 1 to approximately 1,800 gpm in mine year 6, and then jump to a peak of approximately 3,900 gpm in mine year 8. Spikes in simulated dewatering rates occur at the beginning of mine years 7 and 8, with total rates of approximately 4,500 gpm occurring in January of mine year 8. Have these volumes been considered in the handling and treatment process?	TM		
	Page 3-7	Section 3.1.4 Recharge		It is stated that the model assumes that 50 percent of all infiltration into the DRSFs will recharge the underlying groundwater. Is this a valid assumption? Please discuss the consequences if this assumption is rate is not accomplished? It might be good to a sensitivity analysis on this. It might be a good idea to do a sensitivity analysis on the other data input/parameter assumptions included in the model. We also recommnend that the potential to have less infiltration be included in an adaptive management plan	PL/LAH		
		Section 3.1.4 Recharge		Is recharge only considered to alluvium? Similar comment to above: DRSF - It is assumed all precipitation that falls on the top of the DRSFs will infiltrate into the underlying rock and be collected as part of toe seepage collection system. Is any lose to groundwater considered? RIBs - Water available to discharge to the RIBs is approximately 500 gallons per minute (gpm) in mine year 1 through mine year 6, and ramps up to near 3,000 gpm rest of the mine operational period. Has there been	TM		

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				an analysis performed indicating the aquifer (zones) can accept this volume of water?			
	Page 3-8 (Graph 3-4)			What are the consequences if is not possible to "infiltrate" all of this available dewatering flows into this RIBs at the rate presented in Graph 3-4. It appears to be a fairly large volume during certain part of the project and it might be good know if there are any alternative plans to process any "excess" flows if the RIBs are not working as needed. Also, it would be good to address what would be the potential water quantity (quality) consequences if these RIBs did not work as designed/anticipated (i.e., see Graph 4-17).	PL		
		3.1.5 – Stream Flow Routing		Where the streams are diverted and not lined, has interaction with underlying groundwater been considered?	TM		
		3.1.6 – Underflows		The Primary means of groundwater discharge in the existing conditions model is as flow to surface streams. Have underflows discharge to underlying aquifer zone(s) been considered (secondary means)?	TM		
	Page 3-3			**Statement:** To simulate the potential effect of climate variation on hydrologic system changes during the mine operational period, the historical record of climate data from PRISM was reviewed to select periods representative of average, above average, and below average conditions for use in the hydrologic model simulations." **Comment:** It should be made clear that these are annual average values. Annual averages are used for several aspects of the hydrological modeling to identify the influence of above and below average conditions. A concern with this approach is that annual averages can severely minimize the influence of above average conditions that occur over shorter time periods (months or days). Ideally, the modelling should be able to address variability at a higher resolution than just annual differences or a robust rationale should be provided to indicate that the modeling approach will be representative of above and below averaged conditions on a monthly or daily time-step. (Also note comment about modeling shifts in climate in separate comment. Should modeling future climate scenarios be based on potential future scenarios vs historic?) The application of average and above and below average conditions appears to be the only measure of variability within this modeling framework. Absent is any sensitivity analysis or uncertainty analysis.	CE/LAH		

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				These two types of analysis are critical aspects of presenting modeling results and need to be included. As one example, there is significant uncertainty in the estimates of evaporation from the pit lake, however, there are no simulations shown to indicate how sensitive this parameter is to the overall modeling results or how applying alternative values will impact the results. EPA has previously raised questions regarding the use of annual average rather than monthly or daily (and continuous). The modeling will be used for NPDES permitting and for comparison to water quality standards. WQS include chronic and acute standards and therefore, the modelling should be conducted to compare effects on a similar timescale. As we understand, the hydro model outputs will be used in the SWWC modeling and that annual averages would not support predictions necessary to determine effects to water quality. Please see earlier comments and discuss how modeling efforts will be conducted to support permitting and impact analysis.			
	Page 3-6			**Statement:** Simulation of individual dewatering wells was not performed, as the groundwater model was developed to simulate average regional conditions using bulk hydraulic conductivity and storativity estimates (BC 2018a)." **Comment**: The source of the bulk hydraulic conductivity values used and how they were derived should be included in this document. Also discuss how variable hydraulic conductivity is within the mine project area and how this variability might provide differing results from using a singular value.	CE		
	Page 3-7			**Statement:** "Water available to discharge to the RIBs is approximately 500 gallons per minute (gpm) in mine year 1 through mine year 6, when significant dewatering at the Hangar Flats pits is planned. It then ramps up to near 3,000 gpm and continues between 2,000 and 3,000 gpm through the rest of the mine operational period." **Comment:** Later on page 4-13 it mentions that RIBs have an important mitigating effect on downstream surface water flows. Given the importance of the RIBs on water flows, additional information should be provided indicating that the proposed rates of infiltration can be maintained without groundwater mounding or other factors that could potentially limit the infiltration rate.	CE		
	Page 3-7			**Statement:** "The side slope areas of the DRSFs are assumed to have recharge and runoff conditions similar to background estimates for valley areas (BC 2018a)" **Comment:** It seems unlikely that recharge and runoff from the DRSF side slopes would be similar to background estimates for the valley due to			

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				differences in grain size, compaction, and slope. Please provide information that supports the idea that the sides slopes behave similarly to background areas, or information indicating that this is such a minor component of the surface area that it does not significantly impact calculations.			
	Page 3-7			**Statement:** " The model assumes that 50 percent of all infiltration into the DRSFs will recharge the underlying groundwater" **Comment:** Please clarify if the 50% value is being applied only to Fiddle and West DRSFs, or to all DRSFs. Also, provide a rationale for how the 50% value was determined.			
	Page 3-10	Section 3.2 Post Closure Model		It is possible that historical climate conditions presented in the PRISM dataset will not represent future climate conditions, specifically precipitation in the area of the project may change from primarily fall/winter snow dominated precipitation system to a rain (or rain on snow) dominated system. This change would likely dramatically impact the spring, summer and fall hydrologic budget and would therefore need to be evaluated when modeling the potential recovery of the system during the post mining period (out to 112 years into the future). Shifts in climate should be factored in to the analysis and adaptive management planning.	PL/LAH		
	Pg. 3-13	3.2.1 - Pit Lake Development		It is unclear what is meant by "a priori". (Because the simulated lake stage and changes to lake stage over time are not known a priori, a series of iterative simulations must be performed to develop accurate estimates of surface runoff to the lakes from the drainage areas above the simulated lake stage that were once runoff-producing but have become submerged, no longer producing runoff.)	TM		
	Page 3-14	Section 3.2.2 Recharge		It is assumed that reclamation activities will return TSF, DRSFs, RIBs and lined diversions to natural background conditions – What would be the consequence if this assumption of "recharge and runoff (of valley floor conditions) from the meteoric water balance" is not accurate? Perhaps use the model to evaluate these potential consequences.	PL		
		3.2.2 - Recharge		The TSF will remain lined and isolate surface recharge from underlying groundwater after reclamation. The post-closure model assumes zero recharge for the TSF area for the entire post closure period. Has run-off infiltrating to groundwater been considered?	TM		
	Page 3-15	Section 3.2.4 Underdrains		This sentence is confusing "Although simulated underdrain flows are returned to the nearest cell downstream of each facility as groundwater, virtually the entire flow is simulated as discharging into the associated stream cell and conveyed downstream as stream flow" – Is the flow from	PL		

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				the underdrains modeled into the groundwater or into the stream reach?			
		4.2 - Drawdown		Alluvium - Drawdown of groundwater within the valley floor alluvium and glacial sediments has the potential to impact local base flows to surface streams and total stream flows. What are the impacts from dewatering streams? This should be carried forward in the impact analysis. Bedrock - Significant cones of depression within the bedrock surrounding the three planned pits are simulated to occur, with drawdowns extending into upland areas and across stream channels. Simulated bedrock drawdowns in this area are not predicted to have a significant impact on flow conditions in overlying alluvium away from the immediate footprint of the Hangar Flats pit. We are concerned that there would be impacts to flow from drawdowns. Please clarify how this would not result in an anticipated impact on aquatic resources.	TM/LAH		
		4.4 - Underdrain Flow		The DRSFs include permeable rock placed in the surface channels prior to placement of overlying development rock. The mine operational period model included drain cells to simulate flows from these underdrains. Is there any water lost to groundwater?			

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